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STANFORD UNIVERSITY CALIFORNIA.

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FOREST INSECT CONTROL.

SEQUOIA NATIONAL PARK

SEASON OF 1918

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Approved:

ASHLAND, OREGON,

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Forest Entomologist.

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MAP SHOWING INFESTATION ON UNIT 10.

MAP SHOWING INFESTATION ON UNITS 11 AND 12.

MAP OF 1917 SURVEY OF SEQUOIA NATIONAL PARK SHOWING CONTROL AREAS
OF 1918 AND PROPOSED WORK FOR 1919.

Summarizing Statement.

Insect control work was initiated on the Sequoia National Park during the season of 1918, following approval of recommendations made in report of December 6, 1917 by the Bureau of Entomology. The allotment of \$1500.00, which was appropriated for this work, was expended principally in the Middlefork and the Marblefork basins of the Kaweah River (units 10 and 11) and a small part of the Cactus Creek watershed (unit 12). This work was directed entirely toward the control of the western pine beetle and the mountain pine beetle in the yellow pine and sugar pine stands, which according to data secured in the 1917 survey were found to be in an epidemic condition.

Unit 10 was carried out as a cooperative project with the Sequoia National Forest which contributed \$684.08 of the total amount of \$1580.00 expended on the unit. This accomplished the treatment of 133 trees with a total volume of 378,610 board feet. Practically all of the accessible area of the unit, about 60%, was covered by the control work. No work is recommended in the Middlefork basin for 1919, as it is believed that the percentage of infestation removed may prove adequate to establish control. The Bureau of Entomology and the Forest Service will continue an intensive study of this unit from an investigative standpoint.

The balance of the \$1500.00 allotment (\$600.05) was expended on the Middlefork basin and a few trees on the Cactus Creek watershed (unit 12) were included. The funds were sufficient to treat only about 20% of the area involved in the infestation of units 11 and 12. Fifty-seven trees with a board volume of 227,330 board feet were treated. This leaves, however,

still untreated a great deal of infestation in the most accessible part of the Park. It is considered that further work will be necessary in 1919 to reduce this below the danger point.

The amount of infestation which will be found on the Marblefork and Cactus Creek watersheds in the spring of 1919 is estimated at 130 trees, or a volume of 328,000 board feet. The treatment of 100 trees, or approximately 250,000 board feet, is recommended as a measure for bringing this under control. The cost of this work, based upon the control data of 1918, is estimated at \$1000.00. It is considered that the successful completion of the work in units 11 and 12 in 1919 will bring the infestation in the pine timber of the more accessible areas of the Park under control and that it can then be maintained with a limited amount of attention annually. The control of infestation in the outlying districts of the Park will be considered later.

It is recommended that a fund of \$1000.00 be expended upon insect control in units 11 and 12 during the season of 1919. It is further recommended that a representative of the Bureau of Entomology again be detailed, as in 1918, to supervise in an advisory way the insect control work in connection with investigations which are being carried on in this region. The methods of control employed will be only those which from a technical standpoint meet the approval of the Bureau of Entomology and which from an administrative standpoint are approved by the Supervisor of the Sequoia National Park.

Control Work- Season of 1918.

(Unit 10)

Control on unit 10 was started in April, 1918 under a cooperative arrangement with the Forest Service and continued until May 20th. About 60% of the entire area of the unit was covered, resulting in the removal of 59.6% of the infested yellow pine volume and 42.6% of the sugar pine. A complete report of this entire project is given in the Conference Plan Report of December 12, 1918.

The work upon the National Park portion of unit 10 was accomplished at a cost of \$896.52. The balance of the \$1500.00 allotted for insect control was then expended upon unit 11 in accordance with the recommendations and report of December 6, 1917. The work was continued from May 21 to June 10 under the field supervision of Mr. Albert Wagner of the Bureau of Entomology.

Control work on unit 11 was started along the extreme southern border of the timber line from Colony Mill and was carried on as far as the funds would permit. Approximately 20% of the area involved in the infestation of units 11 and 12 was covered, resulting in the treatment of 28% of the infested volume of yellow pine and 56.6% of the sugar pine. As the centers of the infestation on a very large part of the area have not been disturbed by control work, it is considered that further work should be continued in new territory in 1919 until a more adequate percentage of the entire infestation has been removed.

Infested Volumes Treated and Cost Data.

The following tables show the volume of infested timber treated and costs of the work on units 10, 11 and 12. The data given here for unit 10 applies only to that part of the area within the National Park.

Volume of Timber Treated.

	--Unit 10--		--Units 11 and 12--	
	No. trees	Volume	No. trees	Volume
Yellow pine	54	142,090	13	44,520
Sugar pine	32	75,030	45	192,910
<u>Total</u>	<u>74</u>	<u>217,110</u>	<u>57</u>	<u>287,330</u>

Costs.

The cost of treating this timber can be classified as follows:

	--Unit 10 --	—Units 11 and 12—
<u>Labor</u>	<u>\$623.87</u>	<u>\$494.50</u>
<u>Transportation</u>	<u>227.00</u>	<u>116.00</u>
<u>Equipment</u>	<u>45.65</u>	<u>1.00</u>
<u>Total</u>	<u>\$896.52</u>	<u>\$600.50</u>
<u>* Cost per tree</u>	<u>12.11</u>	<u>10.53</u>
<u>Cost per M.B.M</u>	<u>4.12</u>	<u>2.64</u>

* Cost for entire unit, including Forest Service lands, given in the Conference Plan Reports, are as follows: Cost per tree, \$11.83; cost per M.B.M. \$4.13.

Percentage of Infested Timber Removed.

The Conference Plan Report for unit 10 gives the volume of infested timber and the percentage treated in the spring of 1916 as follows:

	-Yellow Pine-	-Sugar Pine-	
<u>Infested Volume</u>	352,280	395,835	5930 352,280 352,115 793
<u>Treated</u> "	209,520	169,920	
<u>Untreated</u> "	142,760	224,915	
<u>Percentage treated</u>	59.5	42.7	

As will be shown later, it is considered that the infestation of unit 11 cannot be separated by any distinguishable barriers from that in unit 12, and the ultimate control of the infestation in this section of the Park depends upon the reduction of the insects in both basins. In view of this, the infestation on unit 11 should be augmented by that on unit 12 to show the total infestation under consideration. This will give the following comparison.

	—Units 11 and 12—		
	Yellow pine	Sugar Pine	
<u>Infested Volume</u>	158,490	322,600	156,490 322,600 48,109
<u>Treated</u> "	44,520	182,810	182,810 44,520
<u>Untreated</u> "	113,970	139,790	227,330
<u>Percentage treated</u>	28%	56.65	

Conditions on Units 11 and 12.

The basin of the Marblefork of the Kaweah (unit 11) lies directly north of unit 10, but the pine type of the two areas is well separated by the broad belt of Sequoia and fir, known as the Giant Forest, and by the brush covered areas to the south. The entire basin comprises about 11,000 acres of pine timber, principally yellow pine and sugar pine, but in the upper part of the basin Jeffrey pine predominates. The Cactus Creek basin (unit 12) is the next timbered watershed north and west of unit 11. The 1917 California survey estimated the acreage and pine stands of these two units as follows:

	: Acreage :	Stand M B M *	
		: Yellow Pine :	Sugar Pine :
<u>Unit 11. Marblefork of Kaweah</u>	11,000	88,000	46,000
<u>Unit 12. Cactus Creek</u>	6,500	42,500	40,000

There are no basins separating the pine type of these two units and the infestation which has been marked is continuous from one basin to the next. From the standpoint of insect control, it is believed that the infestation in both watersheds will have to be considered as a whole. There is little prospect of protecting one watershed unless the infestation in the other is reduced below the danger point.

The progress of the infestation since 1916 is shown in the tables on pages 10 and 11. These show that in both units the western pine

beetle and mountain pine beetle have been increasing rapidly.

Units 11 and 12 were kept under constant observation by Mr. Wagner during the season. By October 1st trees attacked during the season of 1918 had been marked as follows:

Unit 11.			Unit 12		
	No. trees	Volume		No. Trees	Volume
Yellow Pine	28	69,260	13	22,850	
Sugar Pine	50	155,580	19	35,330	
Jeffrey Pine	15	22,150	1	2,000	
Total	93	245,970	53	56,180	

These figures include trees of the first generation which were attacked in the early part of the summer and abandoned before fall, but does not include all of infested trees in which broods will overwinter for the reason that undoubtedly the foliage of some of these latter had not faded at the time field work was discontinued on October 1st.

KAWeah PROJECT

UNIT 11.

SUMMARY OF ANNUAL LOSS .

	YELLOW PINE			SUGAR PINE			JEFFREY PINE		
Year	Dendroctonus brevicomis			Dendroctonus monticola			Dendroctonus jeffreyi		
	No. trees	Vol.	%	No. trees	Vol.	%	No. trees	Vol.	%
1916									
: Second									
: Generation	6	10,440					17	85,020	
: Total D.B.H.	176			: Total D.B.H.	764		: Total D.B.H.	334	
: Av. Dia.	29.3			: Av. Dia.	44.9		: Average Dia.	27.8	
: " Vol.	1740			: " Vol.	5000		: " Vol.	1389	
1917									
: First									
: Generation	25	63,850							
: Second									
: Generation									
: A Trees				: A Trees			: A Trees	11	15560
: Treated	12	44,520		: Treated	45	182,810			
: Not treated	30	56,490		: Not treated	36	105,560			
: Total—	67	164,850			81	288,370			
: Total D.B.H.	2224			: Total D.B.H.	3088		: Total D.B.H.	528	
: Average Dia.	35.2			: Average Dia.	59		: Average Dia.	29.8	
: " Vol.	2460			: " Vol.	3560		: " Vol.	1414.5	
1918									
: B Trees				: B Trees					
: First and Second				: First and Second					
: Generations				: Generations					
: To Oct., 1918				: To Oct., 1918			: To Oct., 1918		
: 28	68,260						50	155,560	

KAWeah PROJECT.

UNIT 12.

SUMMARY OF ANNUAL LOSS.

Year	YELLOW PINE		SUGAR PINE		JEFFREY PINE	
	No. trees	Vol.	No. trees	Vol.	No. trees	Vol.
1916	Dendroctonus brevicornis		Dendroctonus monticolae		Dendroctonus Jeffreysi	
	Second Generation		First or			
	10	15510	2nd Generation	4	7020	
	Total D.B.H.	262	Total D.B.H.	116		
	Average Dia.	28.2	Average Dia.	29.5		
	" Vol.	1331	" Vol.	1755		
1917	First Generation		First or			
	12	31740	2d Generation	4	15650	A Trees 1 1050
	2d Generation					
	A Trees	25	57490 A Trees	7	20590	
		57	89230	11	34230	
	Total D.B.H.	1280	Total D.B.H.	454	D.B.H.	50
	Average Dia.	34.6	Average Dia.	39.4	Average Dia	50
	" Vol.	2411	" Vol.	3111.8	" Vol.	1950
1918	B Trees to		B Trees to			
	Oct. 1, 1916	15	Oct. 1, 1916	19	33330 B Trees	1 2000

Estimates of Infestation and Recommendation for Further Work in 1919.

No further control work is recommended for the season of 1919 on unit 10. This area will be kept under close observation as a part of the Ashland Conference Plan. The results obtained from the work carried on in 1918 will be evident within a year or so and if the percentage removed proves effective further expenditure will be unnecessary.

It has been shown that only a very limited amount of infestation was treated in units 11 and 12. Because of the value to the Park of the forests within these watersheds, the entire infestation should be brought under control as soon as possible, and for this reason further work is recommended on that part of the area which was not covered by the 1918 control work. By applying the factors mentioned to the data which we now have of the 1918 attack on these units, the infestation which will be found in the spring of 1919 is estimated as follows:

Estimated Infestation for Spring of 1919 on Units 11 and 12.

	No. trees	Volume
Yellow Pine	45	100,000
Sugar Pine	70	200,000
Jeffrey Pine	15	28,000
<u>Total</u>	<u>130</u>	<u>328,000</u>

To successfully control this infestation may require the treatment of approximately 100 trees. On the basis of the cost of the work carried on in 1918 this will require an expenditure of \$1000.00.

The infestation which it is proposed to treat is situated in the most accessible part of the National Park, a great percentage of it being located within reach of the road between Colony Mill and the Giant Forest. These conditions should make it possible to work out the infestation at less expense than in less accessible areas, such as unit 10. The cost of transportation, which involved about 30% of the expense on unit 10, can probably be reduced in the Marblefork area. It is believed that conditions here lend themselves readily to a system of working infestation which has never been given a thorough trial in the administration of a control project. Because of this it is suggested that the project be undertaken under a different working plan from that employed in 1918.

The plan of work carried out in 1918 in cooperation with the Forest Service consisted of the employment of as large a crew of men as could be handled with a view of completing the project in a short period. This involved the employment of a coek, heavy transportation charges, the necessity of carrying some inexperienced men in the crew, with considerable supervision and overhead expense.

In a conference with Mr. Frye on August 20th a plan was discussed which would modify considerably this procedure. It was considered that the same amount of infestation can be removed by employing a small crew of men for a longer period and that the cost of a work, if properly directed, will be less than under the large crew system. One of the greatest problems in the practical application of control work, in the type of infestation such as we have on the Sequoia, is to get the crews to and from widely separated groups of trees without a great deal of time lost in walking to and from camp, or undue transportation expense.

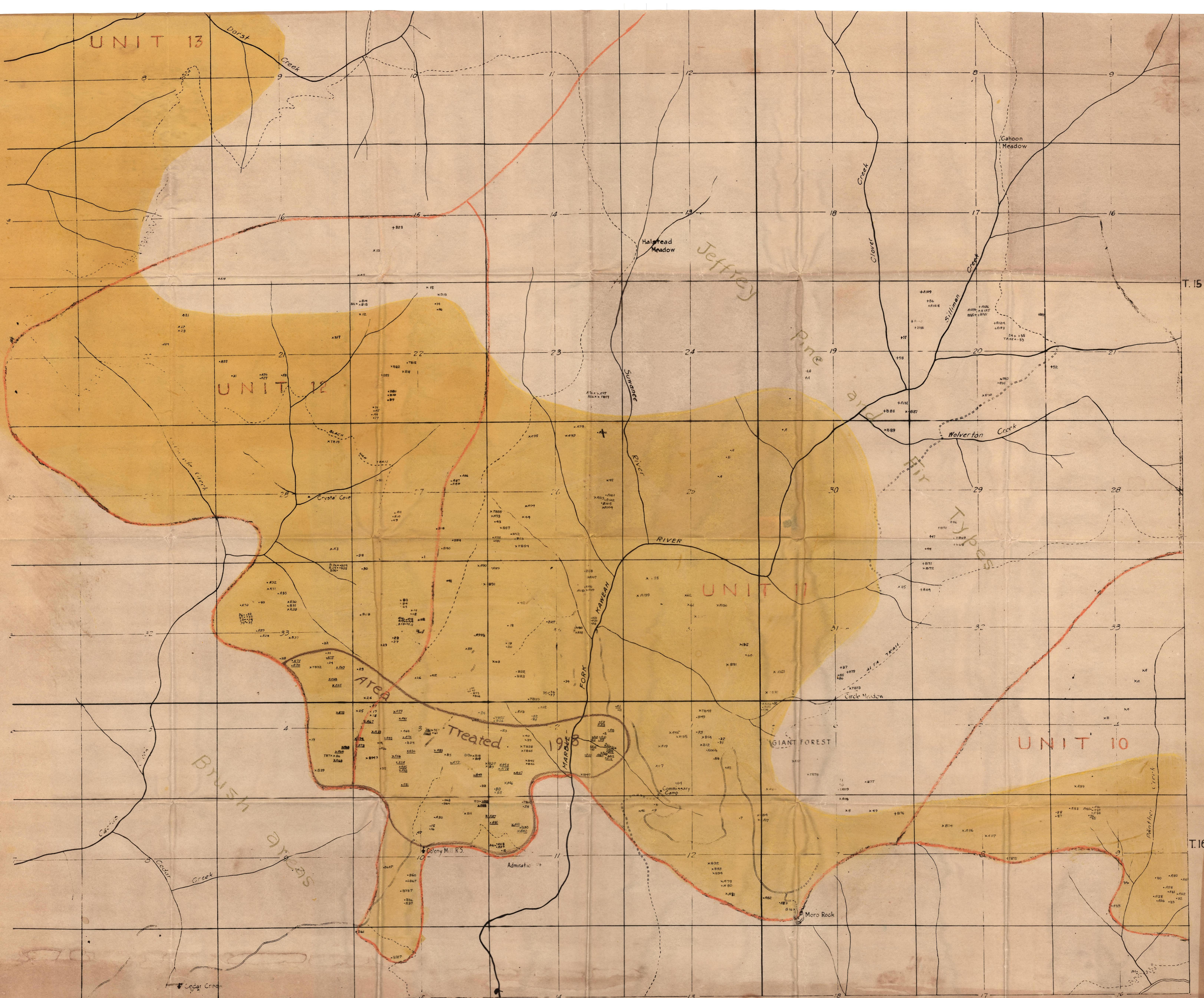
involved in moving camps. With Mr. Frye's approval it is proposed that an effort should be made to try out insect control on a basis similar to that on which some of the trail repair work of the Park is now conducted. This will involve the employment of a small crew of two or at most three men engaged to work on a fixed rate per day and provide their own subsistence in camp and equipped to move camp as often as the work may require. This method was used to a limited extent on the Yosemite in 1918 with a resulting cost about 50% lower than on the Ksweah projects. By careful planning of the project and selection of the trees to be treated the work can be continued over a longer period than that covered by the working period of 1918. The control work of 1918 demonstrated that when top-killed and doubtful trees have been felled during the spring and early summer, the uninfested portions of the tree invariably trap heavy broods, both of the western pine and mountain pine beetles. The cutting and treatment of undesirable trees as trap trees can be used as a means of improving the stand as well as reducing the beetles. It is apparent that by a judicious selection of suppressed and injured trees to be used as trap trees it will be possible to continue the control work throughout the greater part of the summer. Work should, however, be undertaken only under the direction of a trained insect control man and the detail of a representative of the Bureau of Entomology to supervise the work as in 1918 is recommended. Entomological Ranger, Albert Wagner, who acted in this capacity in 1918 in connection with investigative work for the Bureau of Entomology, should be detailed again if available.

The direct purpose of any method employed is to reduce the epidemic infestation to a normal condition as soon as possible by the most

effective and economical methods. Once this result has been accomplished control can then be maintained at a very low annual expense, as it will only be a question of meeting promptly any aggressive attacks that may develop.

The three units which have been under consideration are located in the most accessible areas of the Park. They surround the Giant Forest and compose therefore that part of the Park which is visited most by the public. They are protected by well defined barriers from the infestation of the units lying north and south of them. For these reasons the protection of the timber within these three units has been recommended as a primary object and it is believed that a campaign of 1919 will carry the work through to completion. The control of the infestation in the outlying districts of the Park can then be taken up as the situation demands, while the maintenance of the control in the three central units will require only a limited amount of attention annually.

The writer feels that an appreciation is due to the personnel of the National Park Service of the Sequoia for the assistance extended to this Bureau in the way of offering every facility available for carrying out the program. The investigative work of the Bureau and the control work of the National Park have been carried on in a spirit of cooperation which could not be better.



SPECIES OF TREE

- Yellow Pine
- ✗ Sugar Pine
- Jeffrey Pine

MARKING OF TREES.

MARKING OF TREES.

Number only - trees abandoned prior to 1918 control work
A and number - trees infested at time of 1918 control work.
B and number - trees attacked subsequent to 1918 control work
Unnumbered with or without A or B - merely spotted.
(Underlined trees were treated and trees without underlining
were not treated.)

EXAMPLE

A 31 - marked 1917 yellow pine not treated
A 45 - treated 1917 sugar pine.

H45 treated 1911 sugar pine.
B - yellow pine tree attacked subsequent to control work
and spotted only.

H45 treated 1911 sugar pine.
B - yellow pine tree attacked subsequent to control work
and spotted only.

Yellow pine-sugar pine type
Boundary of Units.

MARBLE FORK INSECT CONTROL PROJECT

Showing Unit 11 (Marble Fork Basin
and Unit 12 (Cactus Creek Basin.)

Scale 4" = 1 mi.

